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OCEANIC CURRENT CIRCULATION.

[A LETTER TO THE PRESIDENT OF THE SOCIETY.]

DEAR SIR—Knowing the great interest that you feel in everything pertaining to physical geography, I am sure you will pardon the great liberty I take in addressing you on a subject that, in my opinion, is of the most vital importance at the present day ; for if we are ever to arrive at just and true conclusions in the science of meteorology, it seems to me that we must begin at the beginning, and as the currents of the air are so dependent, as we know them to be, on the currents of the ocean, a solution of the original momentum of oceanic current circulation seems to me to strike at the very root of the matter. Once settle that moot-point, and it is probable that a thousand questions now pending may be easy of solution.

Oceanic current circulation has for many years past been a subject that has occupied the attention of some of the most learned men of the day, and so varied have been the opinions on the matter, that it would take a volume to give but a passing glance at each theory as it has been laid before the public. I believe I have read most of the treatises of these authors, but I must say that my views differ so much from theirs, and I seem to have such a faint perception of the meaning of some of their propositions, that I can only come to the conclusion that they are not intended for men of ordinary faculties like myself. Some are so abstruse in their reasoning, that I invariably find myself “ out of soundings ” before I have got half through, and the fog of a November day in London could not be more impenetrable. It has suggested itself to me to have a word to say on this subject, for I cannot help thinking that a little practical experience is worth a world of theory ; what I have to state is simply facts, gained from an experience of twenty-seven years as a sea-faring man.

No sailor, before the days of steam, ever contemplated a passage to the westward round either Cape Horn, Cape of Good Hope, or Cape Lewin, in Australia, without a species of repugnance, for it meant great bodily suffering, wet clothes by day, wet bedding at night. Day after day when the reckoning has been obtained, it has frequently been found that, instead of making progress, the ship is actually to leeward of her position on the preceding day ; winds and currents in these latitudes seem as if designed to break down the courage and patience of the stoutest heart ! I look back myself to my early sea-faring days, with a species of shudder, when I think of all that it cost in bodily suffering to gain “ an offing ” of any of these great southern promontories. The question naturally arises, what is the cause of all this ? The answer is simple ; the winds and the currents in the Antarctic are from everlasting to everlasting from the westward.

Take a globe and turn the south pole uppermost, and you will see before you a hemisphere nine-tenths of which is water, and between the fifty-fifth and sixty-fifth parallels of latitude no land intervenes to break the circle ; in fact, you have here a perfect zone of water around the whole circumference of the globe, about 600 miles wide at its narrowest part, by an average of two miles deep. It is on this circle that I base my theory. The earth, in its diurnal revolution of nearly a thousand miles an hour from west to east, causes the water on this circle to flow at a speed slightly in excess of itself ; for it is a well-known fact that water placed on a rotating surface will be thrown from the center to the periphery ; so with the waters of the Antarctic — they are thrown from an un-

known center at the south pole, towards the equator; and I am firmly under the impression that were there no land whatever in the southern hemisphere, so great would the speed become as it neared the equator, that every drop of water on the surface of the earth would be thrown into space. As it is, the space between Cape Horn and the Antarctic continent acts as a safety-valve, to govern the mechanical motion of the currents of the ocean. Make that passage wider, and you would increase, proportionately, the flow of all these currents; stop it, by raising the continent of South America out of the water and joining it to the Antarctic continent, and at once you paralyze the whole system of current circulation, for this circle bears the same relation in the momentum of the currents of the ocean that the crank does to the steam-engine; it gives (if I may so term it) the necessary swing to the waters on this circle, that provides the power to propel them to the uttermost regions of the earth.

Now, let us see how existing data, taken from charts prepared by the first hydrographers of the day, carry out this theory. You will observe that on the circle that I have described, all arrows point eastward; but on coming in contact with the Horn, the Hope and the Lewin, they are split — one-half flowing eastward (the great arterial current), the other half (the deflecting current) flowing northward. Now, let us follow up one of these deflecting currents, and, as so much has been said of the Gulf Stream and its origin, let us see if this theory will not give a reasonable solution of that vexed question. As soon as the waters of this grand arterial current on the circle have passed the Horn, they open out, fan-shaped, as all water does after it has passed a barrier, and the barrier in this case is the comparatively narrow space between the Horn and the Antarctic continent. The northern portion of the current flows northeast, and, impinging on the western coast of Africa, flows directly northward at a velocity of nearly three miles an hour, until the contour of the land on the coast of Guinea gives it a westerly direction; the whole mass of water is then shot right over to the northeastern coast of South America, following the land through the Caribbean sea into the Gulf of Mexico, and so out in the Atlantic by the Gulf Stream. From my own personal observations along the whole of the west coast of Africa, from the Cape of Good Hope on the south to Cape Palmas on the north, and from Cape St. Roque, in South America, to the entrance of the Amazon, I speak advisedly, and without fear of contradiction, when I say that the whole of the currents along these coasts flow as I have described, at a speed, at several different points, of from three to four miles an hour. Independent of the original momentum given to these currents by the earth's rotation, it is very much augmented by evaporation in the tropics, together with the everlasting westerly winds blowing in the Antarctic, and, consequently, the volume of water passing out by the way of the Gulf Stream is small compared with that passing the Falkland islands on its way north.

The same rule holds good on the western coast of America, and the western coast of Australia. The cold waters of the Antarctic are sent north to cool the heated regions of the tropics. These are all surface-currents, as has been fully proved by the recent discoveries of H. M. S. "Challenger;" underneath them are sub-currents, running in nearly an opposite direction, for on the western side of both the Atlantic and Pacific oceans, we see the arrows nearly all pointing southward. Begin at Smith's sound, in the Arctic regions, and until you reach the Gulf Stream on the coast of Florida, all arrows point southward; but at this point the specific gravity of the water being so much greater than that of the water proceeding from the Gulf of Mexico (because so much colder), the former currents pass right under the latter to cross out again on the eastern coast of South America, where once more all arrows point southward; this, too, I know from actual experience, for no more disagreeable task could be assigned

any man than that of having to beat a ship from Rio de Janeiro to Pernambuco in the months of December and January, when all winds and currents seem to stick to one point—*i. e.*, northeast. Light head-winds and strong head-currents, register facts of this description indelibly on a man's memory, as all experience gained by suffering does.

The great point to be settled is this—what is the original motion that sets all these currents running? Would the westerly winds in the Antarctic do it, unassisted by any other power? I, for one, do not think so; and for the same reason as was given by Maury, in his controversy with Dr. Carpenter on the subject, when he says, that “if wind has such a powerful influence in moving vast bodies of water, how is it that the sea-weed in the Sargasso sea retains its position from age to age, although traversed by the powerful northeast trade-winds? Solid substances floating on the surface of the water must perforce be moved more readily than water itself; still, where water has a tendency from other causes to move in a given direction, it may be easily imagined that wind might materially assist it, when constant in its direction.” The evaporation theory of Maury I cannot entertain for one moment, as being the sole cause of the movement, for were such the case, would it not be likely that all currents would tend from the poles towards the equator in an equal proportion? The theory lately set forward by Dr. Carpenter, I do not understand, so I will not attempt to controvert it, but I would conclude by saying, that if the Council of the Geographical Society of America will investigate this matter, taking my humble experience in connection with the data provided by the first hydrographers of the age, they will see a harmonious combination of facts upon which to base an opinion of this vexed question.

In conclusion I would remark that Humboldt, when writing on this subject, said “that the secret of the momentum of the currents of the ocean would be found south of the Cape of Good Hope.”

I am, dear sir, your obedient servant,

THOMAS LEATHAM.

NEW YORK, *May* 4, 1876.